NRAP Phase II Tools and Workflows: DREAMv3

at the 2021 GWPC Annual Forum

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NRAP
National Risk Assessment Partnership

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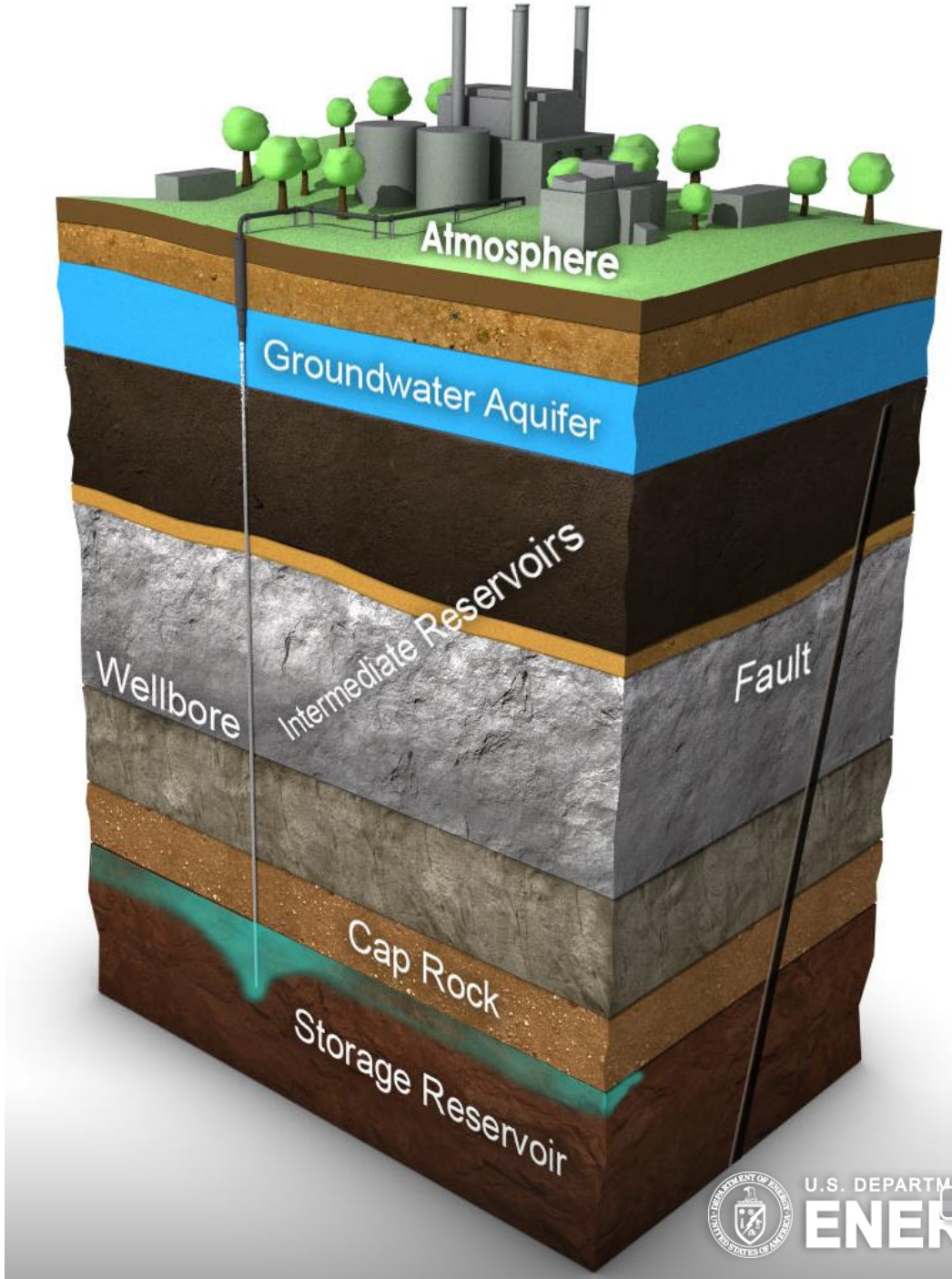

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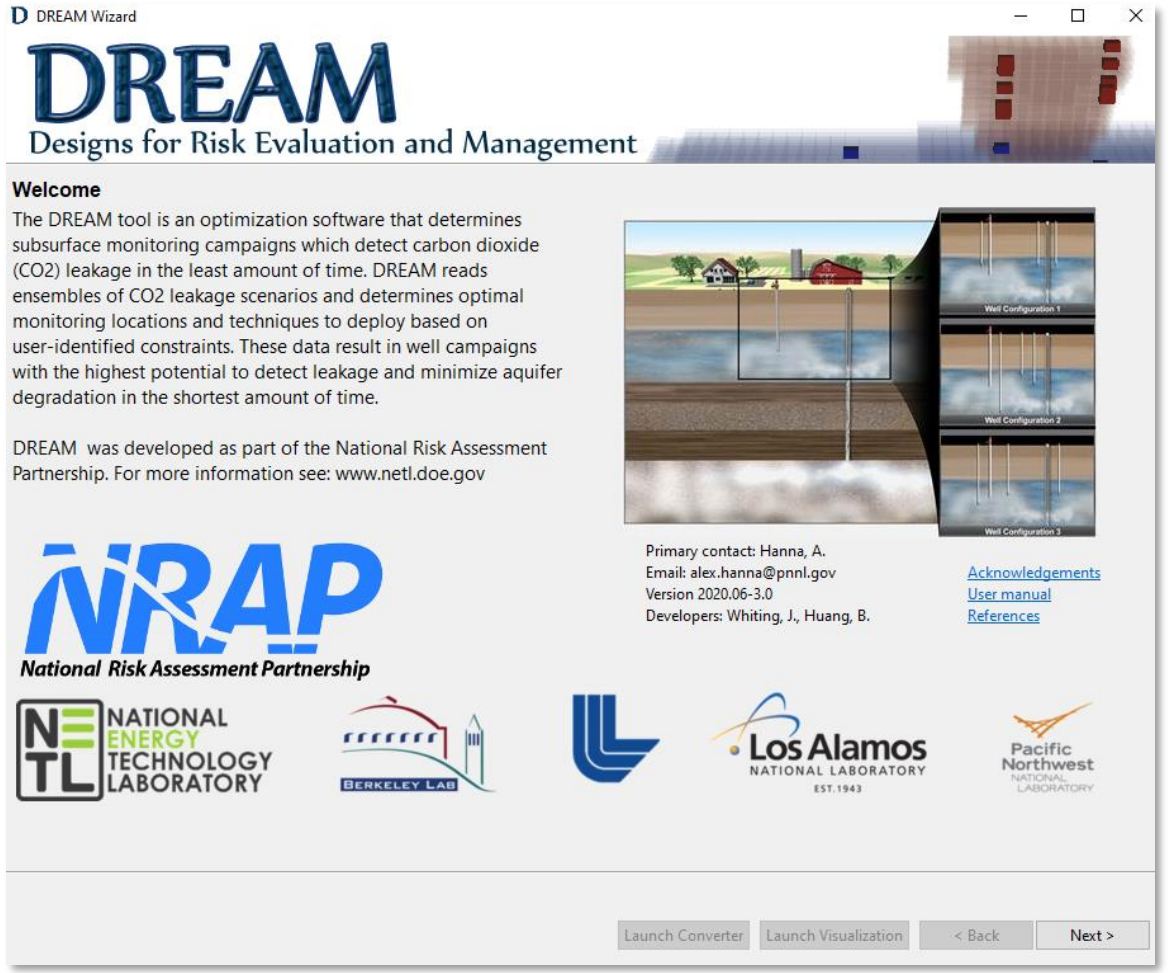
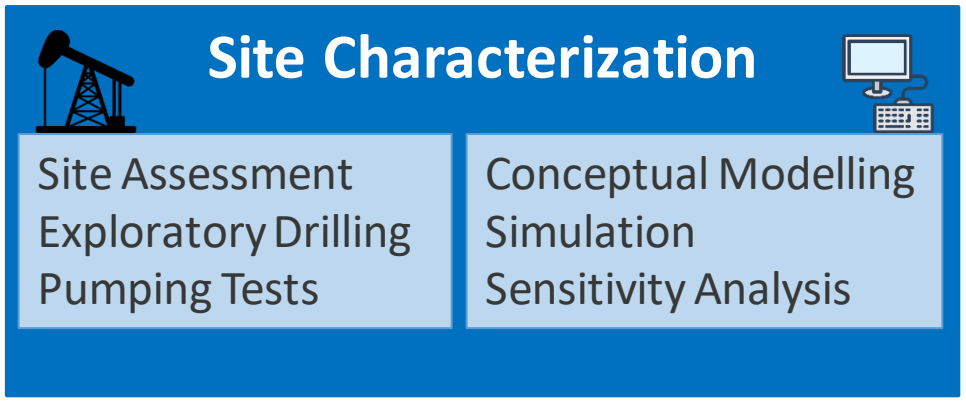
DREAM Overview

Designs for Risk Evaluation and Management (DREAM) leverages output from reservoir simulators to design risk-minimized monitoring plans.

- Configurations are optimized based on sensor locations and specified monitoring parameters
- A defined budget limits the number of monitoring wells and technologies
- DREAM iterates across placement scenarios until it converges on the optimal configuration of sensors



DREAM Workflow



DREAM V3

- Uses a computationally-efficient simulated annealing approach
- Evaluates 100k+ potential monitoring plans for 1k+ simulated hypothetical leaks

DREAM Workflow

Site Characterization

Site Assessment Exploratory Drilling Pumping Tests	Conceptual Modelling Simulation Sensitivity Analysis

INPUTS

Leak scenario: Output from full-physics simulators (TOUGH2, STOMP, …) or ML approximations

Sensor information
- **Type:** Pressure, CO2 sat., gravity…
- **Detection threshold**

Constraints (budget, drilling access, etc)

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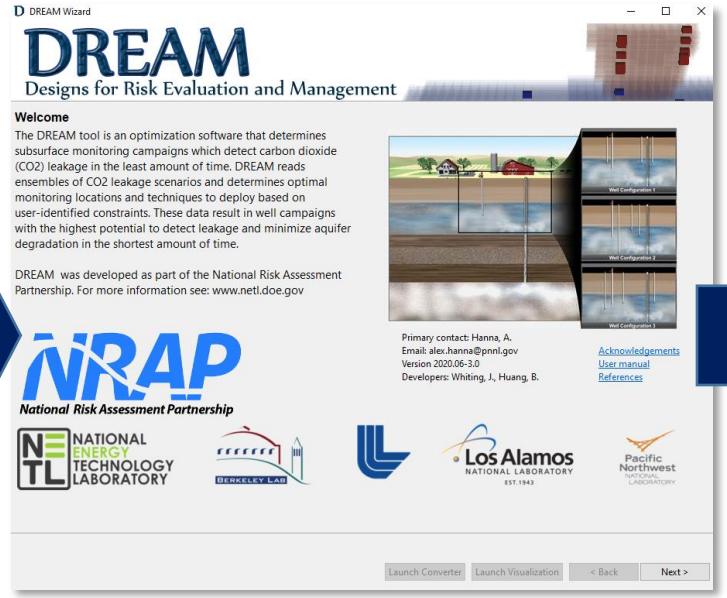


Monitoring plan

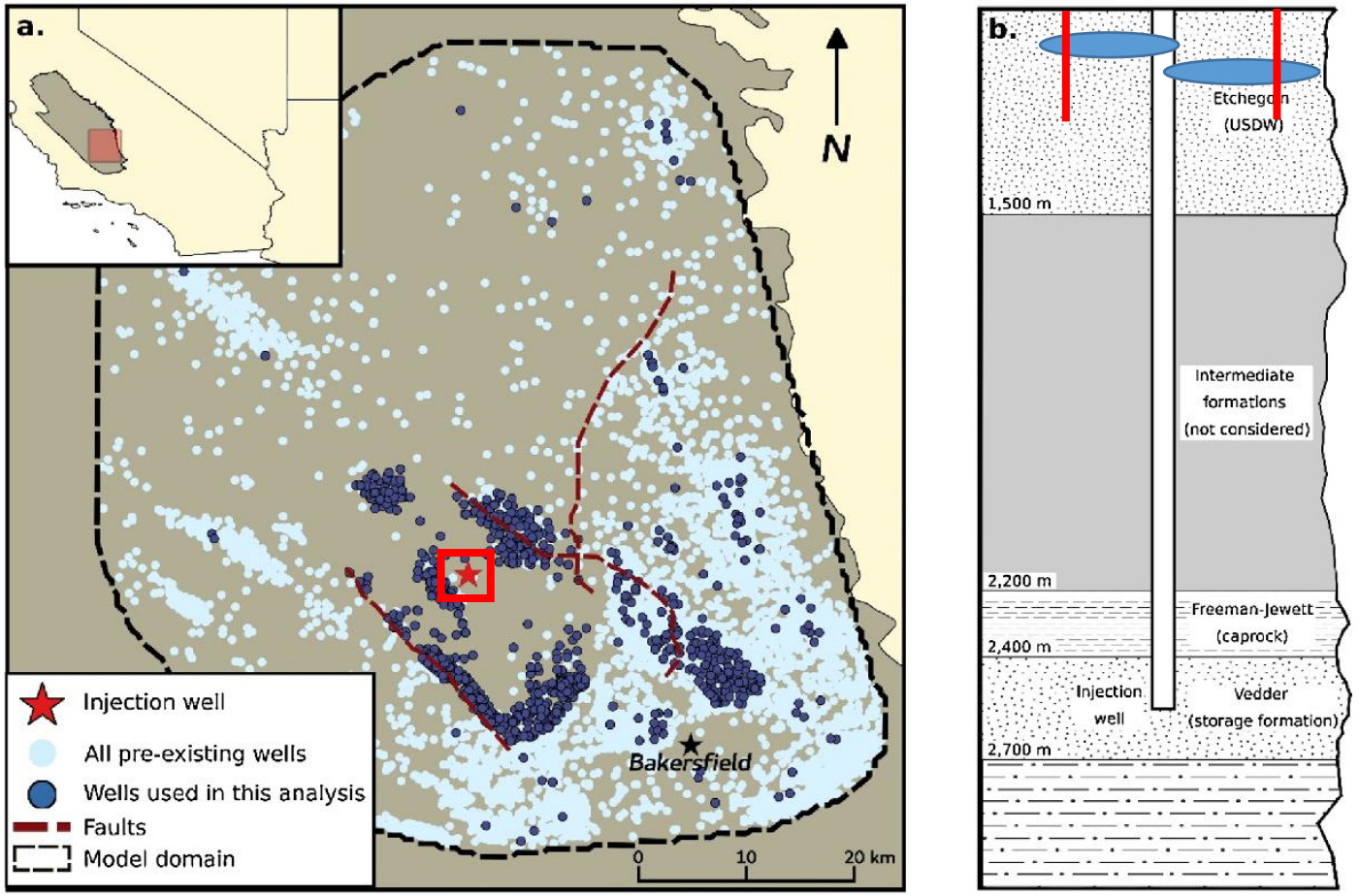
Optimally protective monitoring plan

Minimize monitoring Cost

OUTPUTS

Example: Site With Many Wells

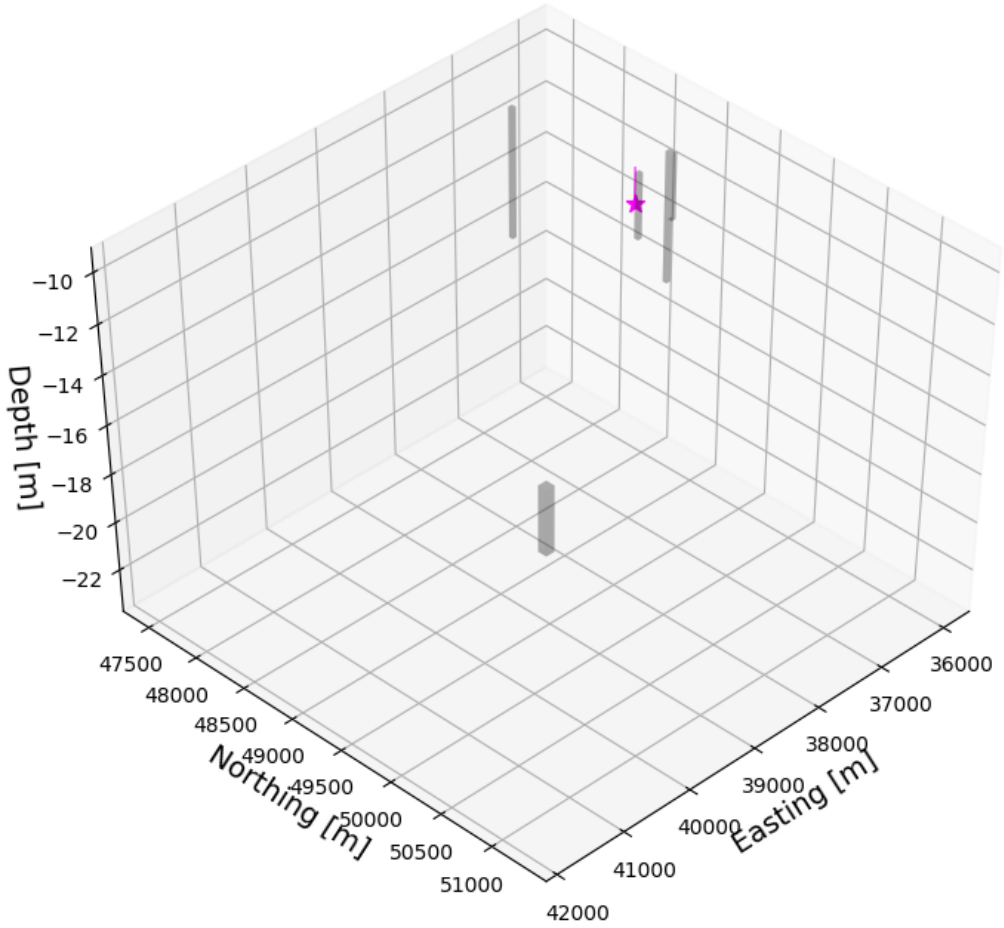
- **Hypothetical Geologic Carbon Storage (GCS) site**
  - Single injection well (250MT over 50 years)
  - Many (37,000) legacy wells
- **Probabilistic leak scenarios from NRAP-Open-IAM**
- **Designated handful of hypothetically leaky wells**
- **Designed optimally protective monitoring plan**

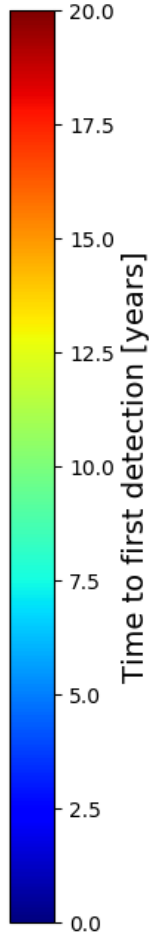


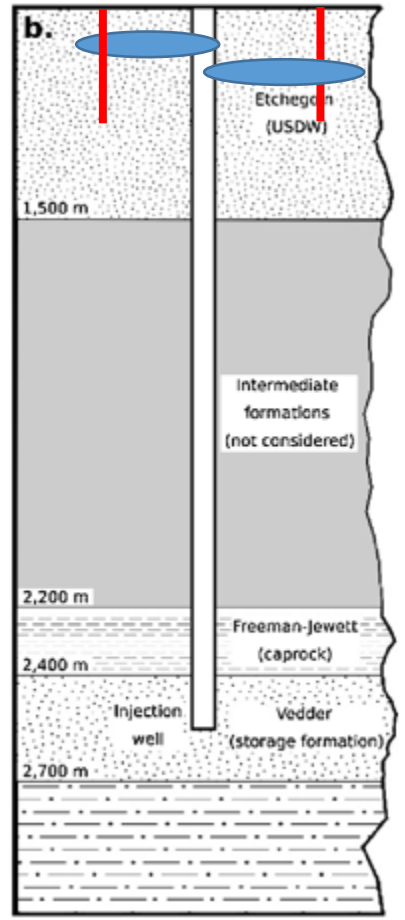
Lackey G, VS Vasylkivska, NJ Huerta, S King, and RM Dilmore. 2019. "Managing well leakage risks at a geologic carbon storage site with many wells." *International Journal of Greenhouse Gas Control* 88:182-194

Example: Site With Many Wells

Kimberlina OpenIAM Model







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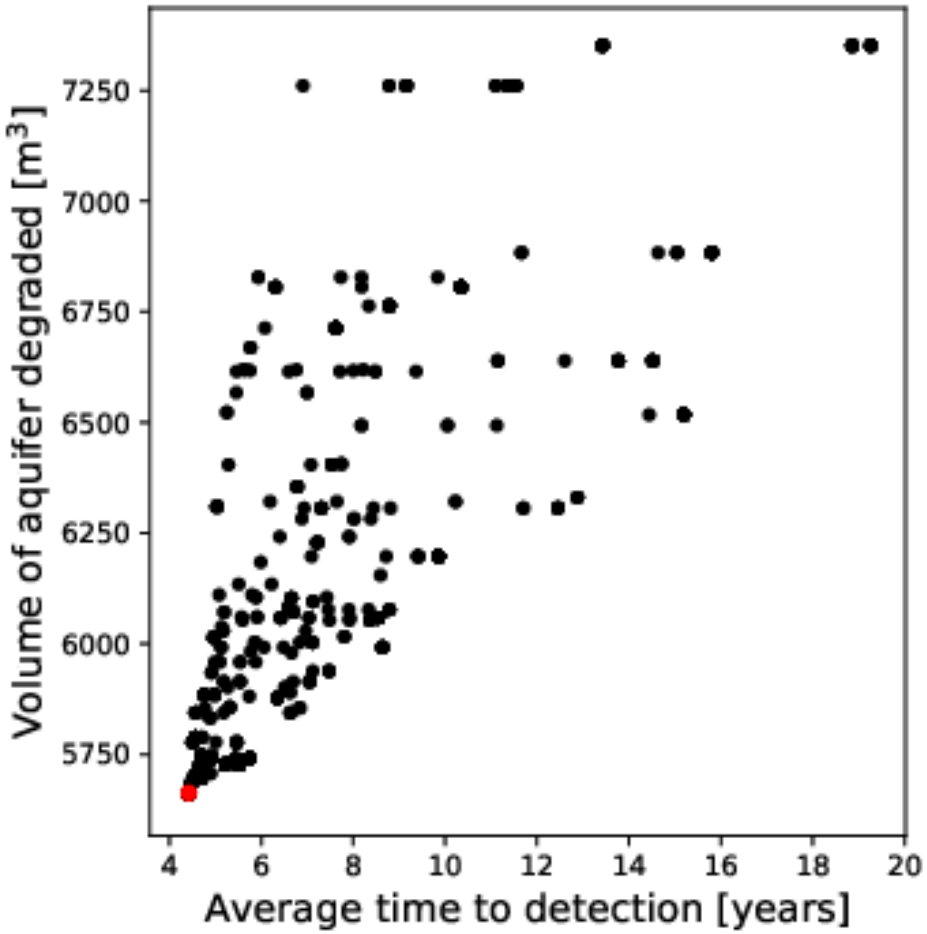
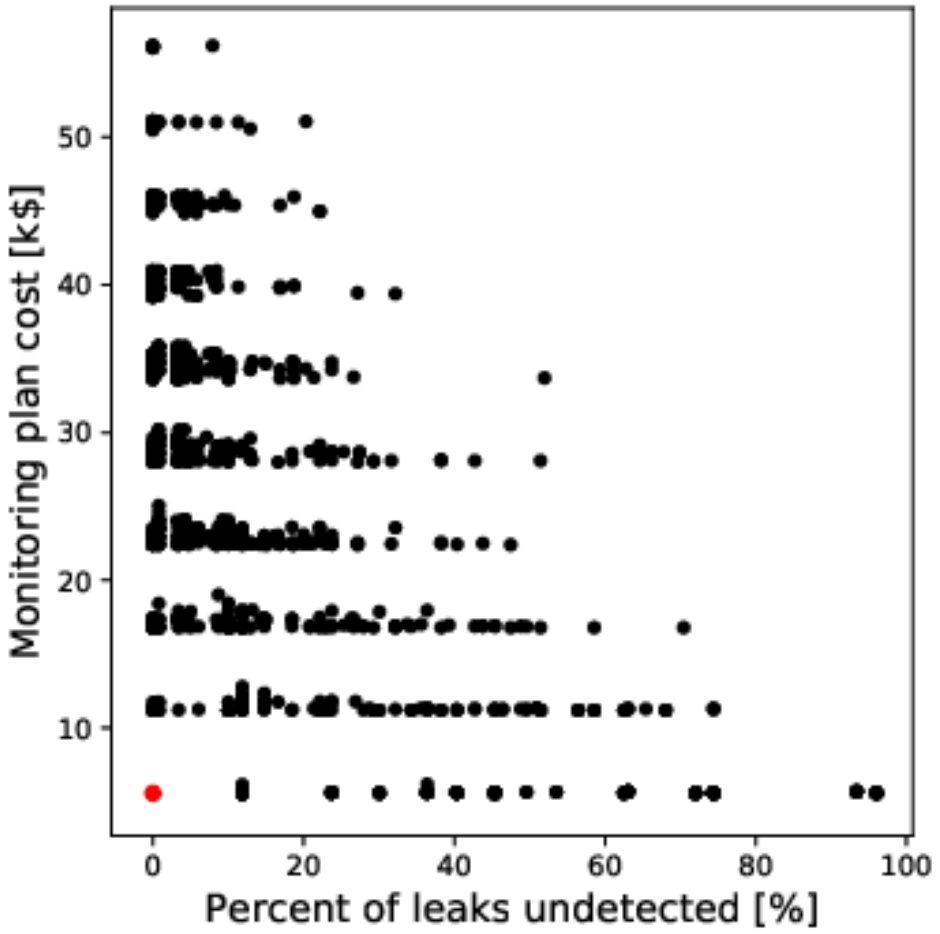
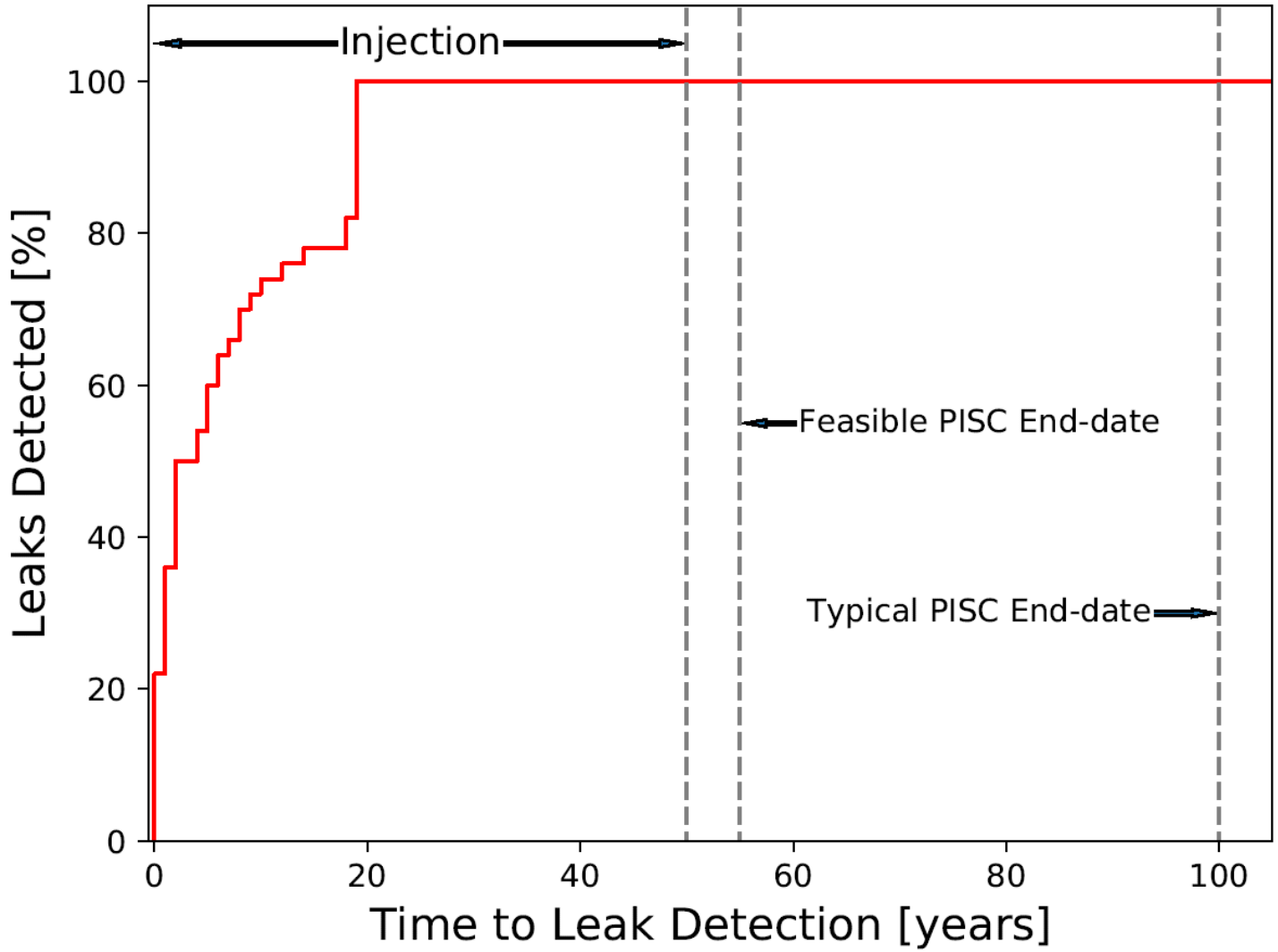




Example: Site With Many Wells

Kimberlina OpenIAM Model

- All leak scenarios detectable within first 20 years
- Quantifies the risks of reducing the post-injection site care period below 50 years

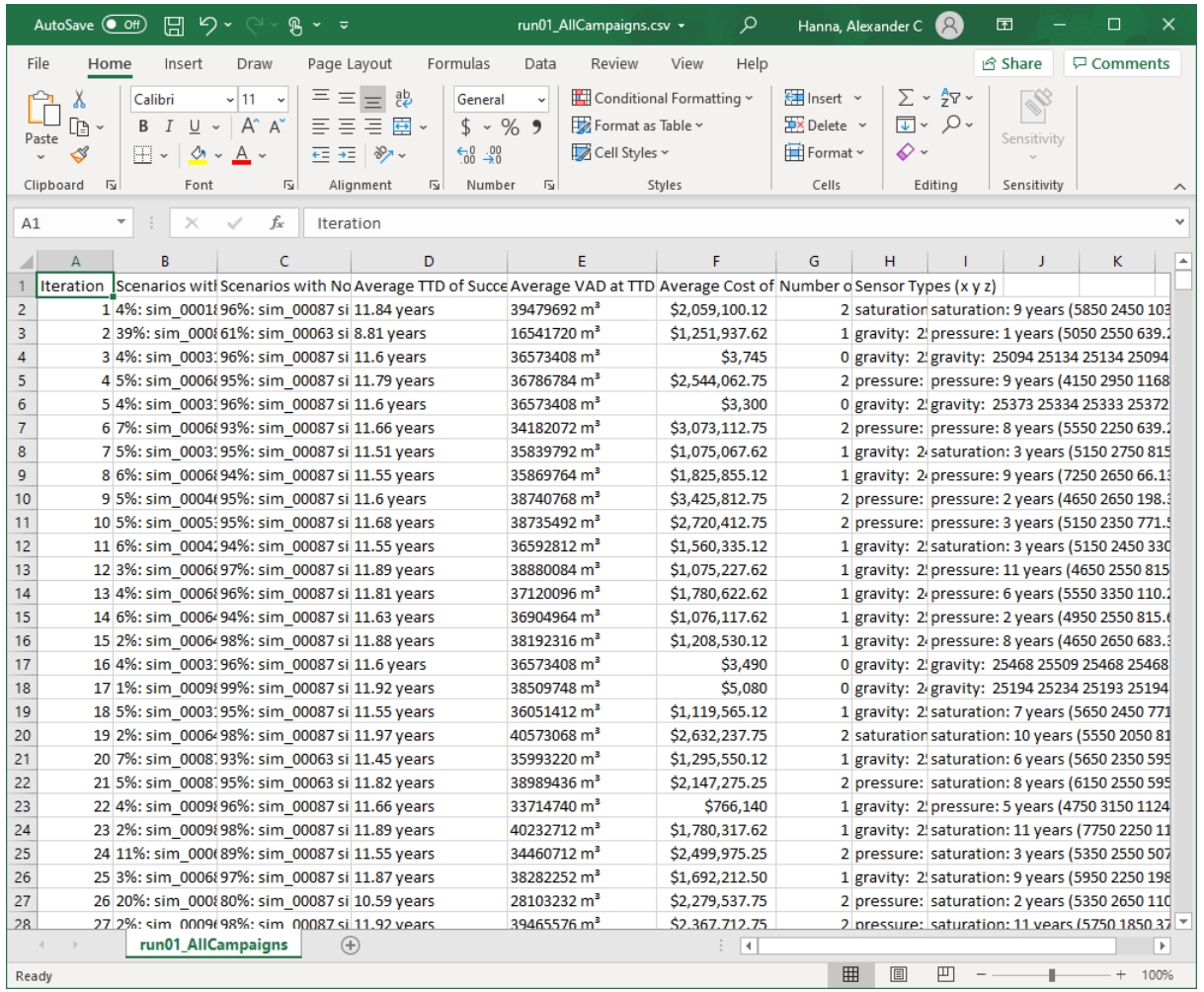


Bacon, Diana H., et al. "Risk-based post injection site care and monitoring for commercial-scale carbon storage: Reevaluation of the FutureGen 2.0 site using NRAP-Open-IAM and DREAM." *International Journal of Greenhouse Gas Control* 90 (2019): 102784.

Walkthrough

Kimberlina OpenIAM Model

1. Provide hypothetical leakage scenarios
2. Define impact thresholds, weighting coefficients
3. Define detection thresholds
4. Restrict number/cost of wells, sensors
5. Select algorithm, number of monitoring plans to evaluate
6. Results available within GUI or excel



Thank you!

Comments and Questions:

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NRAP Website: https://edx.netl.doe.gov/nrap/

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